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PROSPECTS OF UPPER DEVONIAN AND EARLIER  
OIL-BEARING DEPOSITS IN WESTERN BASHKIR

A. A. Trofimuk

In May 1940, test well No 1 near the Ardatovka road, Tuvmazinsk Rayon, Bashkir ASSR, disclosed below the "domanik" strata of the Fransk formation belonging to the Upper Devonian, a sand-clay block with seams of limestone with an average thickness of 75 meters at a depth of 1,738 meters, the test well reached magmatic rocks of the fundamental pre-Cambrian rocks.

The total thickness of the sandstone seam reached 20 meters and its very upper seam proved to be saturated with petroleum. The fauna found in one of the lower seams of the limestone indicated a relationship between the discovered deposits and the Givetian formation of the Middle Devonian.

A few months later, in Syzran at Samarskaya Luka, test well No 49 revealed a similar sectional picture of Devonian deposits, occurring also directly on crystalline rocks of the pre-Cambrian fundament.

A. D. Arkhangel'skiy and I. M. Gubkin's prognosis concerning the presence, at the bottom of the Upper Devonian and in the Middle Devonian, of sandy collectors — possibly new petroleum horizons — was confirmed by means of sectional profiles revealed by the mentioned wells.

However, the problem of the industrial oil bearing of the Devonian sandstones has not yet been solved. These sandstones appeared to be water bearing at Samarskaya Luka, whereas in Ardatovka testing for petroleum beds, underlayed with water, disclosed strongly mineralized water together with a film of petroleum. Evidently, the wells disclosing the Devonian deposits were sunk in an unfavorable structural site.

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Special test well No 100 was sunk in 1943 over the Tuymaz structure, being situated near the anticlinal part of the structure. The well was to reveal the whole sectional profile of the Devonian deposits and to determine if they were oil bearing. Boring operations were started in February 1944, and in September, at a depth of 1,650 meters, forceful oil-bearing horizons were revealed, coinciding with the ~~stratum~~ stratum discovered in well No 1 (Ardatovka).

During testing of the lower oil bearing layer a powerful oil gusher started to spurt.

Thus, new, highly-productive Devonian oil horizons were developed in the Tuymaz stratum, transforming it from a one- or two-layered deposit of small output (carbonaceous horizons) into the many-layered, richest oil deposit in the East.

The Devonian oil at Samarskaya Luka near the Stavropol and the Krasnodarsk wells, sunk in 1944 in Molotovsk Oblast, bear witness to the regional expansion of the Devonian sandstones in the boundaries of the eastern part of the Russian platform. The prospect of developing and mapping hundreds of platform-type structures increased here immeasurably.

The discovery of Devonian petroleum in the region between the Volga and the Ural is a new stage in the creation of a second Baku. This vast region has proved to have tremendous oil reserves and is the basis for the development of a large-scale oil industry. The revealed oil horizons, however, do not exhaust the oil-bearing prospects of this territory.

The data available at present indicates a possibility of disclosing here and there equally-rich prospective oil horizons.

In the boundaries of the Tuymaz structure, are embedded, some directly on the washed-out surface of the crystal bed and some on its coarse-grained alluvial sediments, sandy-clayey deposits one to 30 meters thick.

Higher up, two seams of limestone up to 30 meters thick are detected everywhere. In these seams are found fauna of the Givetian formation. The sandy-clayey deposits lying under the seams of the limestones must be assumed to pertain also to the Givetian formation.

In the deposits of the Givetian formation is embedded a sandy-clayey layer with limestone seams, containing the fauna of the lower beds of the Fransk formation of the upper Devonian. The average thickness of the layer is 90 - 100 meters. This layer is productive and is composed of three blocks of sandstone, saturated with petroleum. In the lower part the layer is a bed of water-bearing sandstone.

At the top of the productive layer is embedded a 2 - 3-meter limestone layer, representing a good marking layer which permits one to set up structural maps that reflect the tectonics of the bottoms of the Fransk formation. Clays lie over this layer, which is composed of a "sub-domanik" stratum 16 - 24 meters thick. The domanik stratum shows limestones with seams of oil shale. It stands out sharply on the core-sample curve by its peak of high resistance.

The average thickness of the domanik stratum in the Tuymaz formation does not exceed 25 - 35 meters. The "super-domanik" stratum, which appears as the upper part of the domanik formation, is of limestone and dolomites having an average thickness of 100 - 120 meters.

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The Famensk formation is limestones and dolomites 250 - 300 meters thick.

In the boundaries of the super-domanik stratum and above the Fransk formation, there are signs of washouts in sand-like forms of limestone conglomerates, and precipitation, as seen from sectional profiles of parts of the structure of certain horizons (electrical core-sampling marks) with corresponding decrease in the cross-sections' size.

Above the productive stratum in the Tuymaz structure is a slanting brachy-anticlinal fold in a northeast course. The fold's southeast wing is far more abrupt, the layer's angles of dip reach 3 degrees; the northwest wing is very alant, and is measured by minutes. The plutonic core of the fold is crystallized, fundamental pre-Cambrian rocks.

The present washout in the deposits of the Upper Devonian, coordinated with the anticlinal part of the structure, gives evidence of the formation of the Tuymaz structure as early as the Devonian period. With respect to the Devonian deposits, the structure's anticline is somewhat displaced in the northwestern direction, relative to the anticline of the structure mapped in the field of Kazan deposits. This is, in short, the construction of the Tuymaz oil formation on Devonian horizons.

Extremely interesting data was acquired in 1945 in the Bayla area, located 20 kilometers southwest of the Tuymaz structure, in the Tatar ASSR. Here test well No 2-E revealed the above-described sectional profile of the Devonian deposits. However, below the Givetian limestones was noticed a sandy-clayey stratum, built primarily of clay 11 meters thick, which later was displaced by a stratum of pinkish-gray arkosic sandstones with small seams. Although 130 meters of core-sampling were looked over in the sandy stratum, no crystallized bed was found. Immediate determinations and electrical sampling measurements showed a significant porosity of these sandstones.

The sectional profile of the sandy-clayey deposits, occurring below the domank layers in Bayla formation, generally appear, in comparison with the sectional profile in the Tuymaz to be three times as big because of the five-fold increase in the sandy-clayey stratum, occurring below the Givetian limestones, and the appearance of arkosic sandstones.

The age of the new strata, disclosed in the Bayla, cannot be determined because of the absence of fauna. The general appearance of the Bayla sandy stratum, the coloration, the different granular "polymictic" character of the sandstone, the stratigraphic situation in the sectional profile, all these point to the possibility of parallelism of these sandstones with the so-called "ashinskaya" formation appearing in sections of the western slope in the Bashkir Ural region.

The outcrop of ancient Paleozoic sandstones in the extreme west of Bashkir considerably widens the prospects of finding new petroleum horizons, coordinated with the deposits of the ashinskaya formation. Especially encouraging in this respect are the structures of the platform type, as well as of the geosyncline type, located in the western part of the republic. As is known, the sandstones of the productive stratum at the bottom of the Fransk formation are not exposed in Ural section profiles. These sandstones are also not found in well No 4/13, situated at Mount Tra-Tau, near Sterlitamak; other horizons known as good petroleum collectors were also not found. The ascertainment of the universal distribution in the Western Ural region of the ashinskaya formation permits one to assume the discovery of good collectors, which are coordinated with this formation in numerous structures, mapped in the Ural depression and in the platform region.

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With this in mind, a thorough survey was started in the boundaries of the Ural depression in Kinzhebulatovo, Karly, and in Krasnoural'sk.

Test well No 154 in Kinzhebulatovo has already reached a depth of more than 2,500 meters. It passed the Permian coal, and Devonian carbonate deposits; at a depth of 2,512 meters, after limestones with fauna of the Givetian formation were discovered, consental sandstones saturated with petroleum were observed. Well No 154 where mining operations are being conducted, has probably already reached the ashinskaya formation. Thus, the presence of petroleum is established in the ashinskaya formation and in the porous sandstones considered as collectors for the industrial extraction of petroleum.

It is difficult to overestimate the role of these facts inasmuch as they expand considerably the prospects of discovering new petroleum horizons on the Devonian petroleum boundaries of the Tuymaz. The revealing of new horizons as possible collectors for industrial petroleum extraction opens widest prospects in revealing new petroleum layers, both in the Bashkir ASSR and in adjoining regions, and in the Tatar ASSR, Udmurt ASSR, and Chkalov, Kuybyshev, Molotov, and other oblasts.

In western Bashkir, geological prospecting work mapped more than 50 structures. Thirty of them are located in the platform area and represent structures of the Tuymaz type, and more than 20 are to be found in the Ural depression. Moreover, the southwestern part of the republic is not embraced in past geological surveys. Here 15 - 20 new structures of the Tuymaz type, judged according to preliminary data, will be discussed.

All these structures, in the light of now data on the oil-bearing capacity of Devonian and more ancient deposits, appear as prospects for revealing new petroleum beds.

In the Bavla structure nearest the Tuymaz a third deep test well is being sunk. The first two wells revealed the same oil-bearing Devonian horizons which are exploited in the Tuymaz.

The establishment of the industrial oil-bearing potential of the Devonian deposits in the Bavla emphasizes even more the probability of discovering new rich petroleum beds in each of the revealed structures.

Deep prospecting boring is in progress over the Mikheylovsk structure, situated 40 kilometers northeast of the Tuymaz. Test well No 2 reached sandstones and coal-bearing formations saturated with petroleum and limestones of the 'Turney'sk' formation.

Within the Tuymaz structure, all manifestations of petroleum in carbonaceous horizons are found inside of the petroleum-bearing periphery of the Devonian horizons. One has to assume that the petroleum-bearing capacity of carbonaceous deposits on the Mikheylovsk structures, too, indicates the petroleum-bearing capacity of Devonian deposits. The Mikheylovsk structure exceeds in dimensions the largest structure in the Far East, the Tuymaz. In this connection, the discovery of the industrial petroleum-bearing capacity of Devonian deposits on this structure has especially important significance.

In the Ardatovsk structure, located 20 kilometers north of the Tuymaz, deep borings are being resumed. Everything indicates that a new highly productive layer, coordinated with the Devonian deposits, can be expected to be developed.

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Borings are also in progress over the Sarayevsk structure, 80 kilometers southeast of the Tuymaz. This structure is one of the largest among those located on the new anticlinal bank.

Carboniferous, Upper Devonian, and earlier deposits within the pre-Ural depression were searched for in the Kinzebulatov, Karly, Shakhany, and Krasnousol'sk structures.

The Kinzebulatovo structure disclosed oil-saturated sandstones coordinated with the bottom of the Fransk formation and petroleum-bearing sandstones of the 'ashinskaya' stratum. Petroleum on a small and nonindustrial scale was revealed by the whole sectional profile of the carboniferous and Devonian deposits.

In the Krasnousol'sk structure core-samplings indicated copious petroleum developments in the sandstones occurring near a coal-bearing stratum, which is the base of the Vizyaskiy formation.

All these facts are evidence of great prospects of new petroleum horizons in the pre-Ural depression.

Vast exploration work is being conducted by the Ministry of Petroleum Industry Eastern Regions of the USSR in the oblasts and republics adjoining Bashkir.

In Tatar ASSR, where the Bavla structure is located, some 40 structures of the Tuymaz type have been discovered. On the more encouraging of these structures, the Shugurovsk where the industrial petroleum-bearing capacities of the Namyur and the coal-bearing stratum horizons have been proved, a search is being conducted for Devonian horizons. Similar work is under way in the Aksubayevsk and Romashkinsk structures.

In Kuybyshev Oblast, along with intensive exploration works in the Samarskaya Luka where Devonian horizons are exploited, a deep boring is being started in the large Baytugansk structure, located on one tectonic line with the Tuymaz and Bavla structures. Here prospective oil-bearing layers were discovered in the Namyur. The earlier deposits undoubtedly will also turn out to be industrially oil-bearing.

In Chkalov Oblast, well No 15 is searching for Devonian horizons in the Buguruslan structure. This well disclosed the same Devonian horizons which are productive in the Tuymaz with its rich sand layers, and by the Bavla stratum with its arkosic sandstones and clays. Since it is located on the structure's wing, the sandstones of the productive stratum are found to be saturated with waters.

Seismic work conducted on the Buguruslan structure established the presence of a structure southeast of well No 15. A new deep well is being sunk here to determine the industrial value of the Devonian horizons.

Devonian horizons are being explored in Molotov Oblast, where their industrial oil bearing capacity is already certain.

In the Udmurt ASSR deep explorations of Devonian horizons are also being conducted on the Izhevsk structure. The discovery of intensive indications of oil in carboniferous deposits promises a successful answer to the question of oil-bearing Devonian deposits in this structure, too.

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The situation as described for the above-listed territories and republics may be extended to other territories and republics, first among which are Ul'yanov, Stalingrad, Astrakhan, Perm, and Gor'kiy oblasti.

Hundreds of structures revealed by geologists in these territories and republics are potentially new and rich petroleum formations.

However, it would be erroneous to say that the explorations of all these structures were easy work. Even slight experience in exploring structures of the platform type shows that discovering oil formations in the boundaries of these structures is not simple in all cases. The fact is, the structures mapped in the field are usually considerably displaced relative to structures folded by Devonian horizons. To facilitate the search for the anticlinal parts of the structures corresponding to deep productive horizons, it is necessary to develop new geophysical methods for disclosing the position of anticlines in Devonian formations, and, particularly, to develop seismic methods for revealing the nature of early layers and the contour of crystallized lower beds. The discovery of anticlinal parts of structures in deep horizons will considerably speed up the tempo and efficiency of exploration for new petroleum formations.

The prospects of petroleum-bearing beds in the vast territory between the Volga and the Ural are magnificent. To discover even a part of the petroleum deposits will make it possible for the Soviet Union to create in the East a large-scale base for the production of petroleum.

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